2/6/18 "The strength to win comes from within."-Anonymous

HW: "Horizontal Stretching of functions" homework section

Test 1 on Thursday 2/15

AIM: How do we recognize a horizontal stretch?

Warm Up:

The function h(x) has a range given by the interval [-2, 8]. The function f(x) is defined by $f(x) = \frac{1}{2}h(x) + 6$.
What is the range of f(x)?

y

y

$-2 \le y \le 8$

$\cdot \frac{1}{2} \qquad \cdot \frac{1}{2}$

$-1 \le y \le 4$

$+6 \qquad +6$

$5 \le y \le 10$

or

$[5, 10]$

① Vertical compression times y by $\frac{1}{2}$

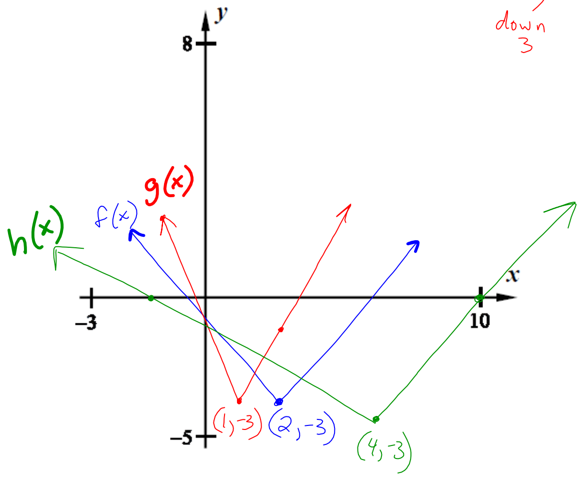
② Shift up 6 units add 6 to y

***Exercise* #1:** Consider the absolute value function $f(x)=|x-2|-3$.

right 2

down 3

(a) Using your calculator, sketch a graph of f on the axes provided. Label the coordinates of its vertex point without the use of your calculator.



(b) Consider the function $g(x)=f(2x)$. Determine a formula for g and then graph it on the axes. Use your calculator to find its minimum point and label it on the graph.

$f(x)=|x-2|-3$

$g(x)=|2x-2|-3$

(c) Now consider the function $h(x)=f\left(\frac{1}{2}x\right)$. Determine a formula for h and graph it on the axes. Use your calculator to find its minimum point and label it on the graph.

$f\left(\frac{x}{2}\right)$

$f(x)=|x-2|-3$

$h(x)=\left|\frac{1}{2}x-2\right|-3$

(d) Summarize your findings below for each function.

$f(x)$ turning point:	$f(2x)$ turning point:	$f\left(\frac{1}{2}x\right)$ turning point:
$(2,-3)$	$(1,-3)$	$(4,-3)$

(e) What stayed constant about the turning points? What changed and how did it change?

y-value stayed the same

The x-value changed by doing the inverse of what was shown.

HORIZONTAL DILATIONS

For a real number, positive constant such that $k > 1$:

1. The function $f(kx)$ represents a horizontal compression of $f(x)$ by a factor of k
2. The function $f\left(\frac{1}{k}x\right)$ represents a horizontal stretch of $f(x)$ by a factor of k.

***Exercise* #2:** Let's take a look at the **quadratic function** $f(x) = \overset{a}{x^2} \overset{b}{-12x} + \overset{c}{20}$.

(a) Determine the coordinates of its turning point by using the equation for the axis of symmetry of $x = -\frac{b}{2a}$.

$b = -12$

$a = 1$

$x = \frac{-(-12)}{2(1)} = 6$

$f(6) = 6^2 - 12(6) + 20$

$= -16$

$\boxed{(6, -16)}$

(b) If g is defined by $g(x) = f(3x)$, what should be the coordinates of its turning point based on our previous work? Explain.

horizontal compression

(Divide x-value by 3)

$6 \div 3 = 2$

$\boxed{(2, -16)}$

(c) Determine a formula for $g(x)$ and then use the turning point formula to verify your answer from part (b).

$g(x) = f(3x)$

$g(x) = (3x)^2 - 12(3x) + 20$

$g(x) = \underset{a}{9x^2} \underset{b}{-36x} + \underset{c}{20}$

$x = \frac{-b}{2a}$

$x = \frac{-(-36)}{2(9)} = \frac{36}{18} = 2$

$g(2) = 9(2)^2 - 36(2) + 20$

$= -16$

Turning Pt

$(2, -16)$ ✓

(d) Show that the y-intercept of both $f(x)$ and $g(x)$ are equal. What does this make sense from a horizontal dilation perspective?

$x = 0$

$f(0) = 0^2 - 12(0) + 20$

$= 20$

$g(0) = 9(0)^2 - 36(0) + 20$

$= 20$